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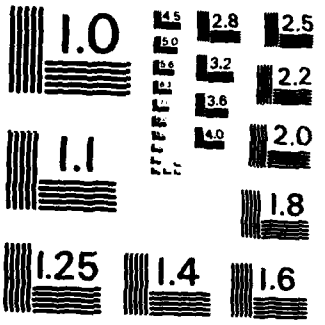

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Random Wave Propagation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A summary of the problems considered, the principal results obtained and the ensuing research publications is presented.

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TWO STOCHASTIC MODELING PROBLEMS IN COMMUNICATIONS AND NAVIGATION

FINAL REPORT

WERNER E. KOHLER

SEPTEMBER 12, 1983

U.S. ARMY RESEARCH OFFICE

CONTRACT DAAG29 79 C 008[illegible]

VIRGINIA POLYTECHNIC INSTITUTE
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Two problems were studied, the effects of random gravitational fluctuations upon the performance of inertial navigation systems and the effect of random scatterers upon wave propagation.

Work on the geodesy problem led to a limiting description of navigational errors as a Gauss Markov process. Such a limiting process is quite amenable to signal processing techniques. Work on the random wave propagation led to the development of a two-frequency stochastic transport theory, new insights into the forward scattering approximation in waveguide propagation and some new results on rough surface scattering. Work on a vector transport theory for electromagnetic propagation through random clouds of scatterers was initiated and some preliminary results have been obtained; this effort will continue.

The following publications were produced:

1) Multiple Scattering and Waves in Random Media, edited by P.L. Chow, W. E. Kohler and G. C. Papanicolaou, North-Holland Publishing Co., 1981.

2) Some Applications of the Coherent Potential Approximation, W. E. Kohler and G. C. Papanicolaou, in Multiple Scattering and Waves in Random Media, pp. 199-223.

3) Two-Frequency Radiative Transfer Equation for a Statistically Inhomogeneous and Anisotropic Absorptive Medium, I. M. Besieris and W. E. Kohler, in Multiple Scattering and Waves in Random Media, pp. 7-42.

4) Boundary and Interface Problems in Regions with Very Rough Boundaries, W. E. Kohler, G. C. Papanicolaou and S. Varadhan, in Multiple Scattering and Waves in Random Media, pp. 165-197.

5) Propagation in a Randomly Perturbed Multimode Matched Waveguide, W. E. Kohler, Wave Motion 4 (1982), pp. 243-263.

6) Bounds for the Effective Conductivity of Random Media, W. E. Kohler and G. C. Papanicolaou, Macroscopic Properties of Disordered Media, edited by R. Burridge, S. Childress and G. Papanicolaou, Springer-Verlag (1982), pp. 111-130.

7) A Transport - Theoretic Analysis of Pulse Propagation through a Random Cloud of Scatterers, I. M. Besieris, W. E. Kohler and A. I. Tsolakis, ARO Report 83-1, Transactions of the 28th Conference of Army Mathematicians (1982), pp. 47-56.

The following Ph.D. Thesis was produced:

Asymptotic Stochastic Analysis of a Gravity Model for Inertial Navigation Systems, Mark Torgrimson, Ph.D. Thesis, Virginia Polytechnic Institute and State U., 1982.

The following publications have not yet appeared:

1) Scattering from Two-Scale Surfaces for Large Distances, Oleg Yordanov, to appear in Radio Science.

2) An expanded version of (7), dealing with a transport theoretic description of pulse propagation through discrete scatterers, is being prepared for submittal to Radio Science.

Werner E. Kohler was the principal investigator on the contract. Mark Torgrimson worked on the geodesy problem for his doctoral dissertation. His thesis is cited above. Oleg Yordanov, a visitor to Virginia Tech from Bulgaria, worked on a rough surface scattering problem. His research will be published in Radio Science. Graduate students Gary Schleuter, Dale McIntyre, Grazyna Slifierz and Helen Zitomer were partially supported by the contract. Schleuter has received his M.S. degree in Mathematics. The others are currently students at Virginia Tech.